Accessible cycling infrastructure

Design guidance note

NZ Transport Agency Waka Kotahi

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More information

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Contents

Introduction

This guidance is intended to inform the planning, design, and auditing of streets and cycle facilities to achieve accessibility by people of all needs and abilities. It forms part of NZTA Waka Kotahi's Cycling Network Guidance and sits alongside other design guidance and standards applicable to the different regions of Aotearoa New Zealand.

This document includes an introduction to disability and cycling in Aotearoa New Zealand, followed by a common range of cycle types used by people with various needs. The design guidance will be useful as a point of reference in street and cycling network planning, route assessment, facility choice, and concept and detailed design. It is presented as a series of common problems faced by disabled people cycling, along with possible solutions. Accessibility audits and monitoring and reporting of existing facilities should also be informed by this guidance.

The Personas section contains profiles of people to illustrate the diverse cycling experiences of disabled people living in Aotearoa New Zealand. These are based on real people interviewed as part of the development of this guidance, with their names and personal details changed to protect their identities. Quotes about their experiences, along with experiences of people who work with disabled cycle users, are also included throughout the guidance.

Appendix A includes the methodology for the development of this guidance, as well as a literature review providing context on disability and cycling in Aotearoa New Zealand.

Figure 1: People cycling have diverse ages, varying abilities, and use a range of cycle types, like this electrically assisted wheelchair handcycle clip on (image credit: Matt Crawford, 2022)

What is inclusive cycling?

Inclusive cycling is cycling which is accessible to all people. An inclusive cycling network will be safer, easier, and more pleasant to use for people on cycles of all ages, abilities, gender, and backgrounds, including disabled people on cycles, people using cargo cycles to transport people and goods, people using mobility scooters, and people using electrically assisted cycles (such as e-bikes). An inclusive cycling network will also foster growth in cycling by those learning and less confident, including children and older people.

In this guidance, we focus on accessible cycling infrastructure that enables more disabled people cycling. When it comes to transport, disability is a result of environments that do not cater to a person's need for access. Streets and cycling networks in Aotearoa New Zealand have typically been designed for non-disabled people riding standard bicycles. So, cycling infrastructure that caters for disabled people is likely to cater for people of various capabilities and needs. This guidance promotes cycling infrastructure planning and design that is more accessible for more people.

It is worth noting that the term ‘cycle’ is used throughout this guidance to include all human powered or electrically assisted vehicles with two, three or four wheels, as opposed to ‘bicycle’ or ‘bike’, as these terms refer to two-wheeled vehicles. The term ‘cycle’ is therefore more inclusive than ‘bicycle’ or ‘bike’, because of the wider range of vehicles it can describe.

Many people use a cycle as a mobility device or have some kind of mobility device that is similar to a cycle in terms of its power and/or size. As well as what we might think of as traditional cycles, this guidance considers mobility devices which may not include a human-powered element, such as a mobility scooter or wheelchair clip-on. These devices are included because they often have similar infrastructure needs to cycle users and they may use cycling infrastructure where it is available. People who use mobility devices are often poorly catered for by:

> *I have an electric wheel clip-on attachment for my wheelchair. It’s got a 20” front wheel and can get me going as fast as e-bikes.*
>
> *I use my clip-on all the time running errands: anything from just up the road, up to 20km.*
>
> Richard, 55, wheelchair clip-on

- Footpaths: which may include steps, often feature poor geometry and sightlines, and people riding can intimidate some pedestrians.
- Busy carriageways: due to the size, speed, and dangers posed by motor vehicles.

Social model of disability

This guide uses the 'social model' of disability, as adopted by the New Zealand Disability Strategy. The social model of disability draws on a human rights discourse, defining disability as being caused by society and a lack of inclusive design. This contrasts with the ‘medical model’ which sees illness or impairment as the sole cause of disability. In the social model, disability is the result of person’s interaction with an inaccessible environment. In the context of cycling for transport, people are disabled by the design of cycling infrastructure which does not enable them to participate. Making cycling infrastructure accessible can provide disabled people with the same access to cycling as non-disabled people.

A note on language

This guide uses the term disabled people, instead of terms like “people with disabilities”. The Ministry of Social Development, as part of the development of the New Zealand Disability Strategy, consulted on the preferred term, finding that disabled people was the preferred term to reflect the social model of disability outlined above. Individuals and groups will have language they feel most comfortable with.

Disability and cycling in Aotearoa New Zealand

In 2013, 24% of Aotearoa New Zealand's population were identified as disabled. Over time, this proportion has been increasing, and that is expected to continue, partially due to our ageing population[1]. It is common for people to be disabled in multiple ways.

A 2021 study in Aotearoa New Zealand showed that 10% of disabled people had cycled in the last week[2]. This is comparable to the 15% of the general population in urban areas who said they had cycled in the last week[3]. Unfortunately, further detailed information from within Aotearoa New Zealand is not available, however a survey of disabled people who ride cycles in the United Kingdom[4] has found:

- Most respondents own their own cycle (87%).
- 77% cycle once a week or more, and 36% cycle daily.
- 64% said cycling was easier than walking, and 59% consider their cycle a mobility aid.
- The most common reasons for cycling are fun/leisure (89% of respondents), exercise (84%), mental health (63%) and general transport (54%).
- The most common barriers to cycling include inaccessible infrastructure (54%), lack of parking or storage for their cycle (35%), and the cost of a cycle or adaptations (33%).

Further information and background on disability and cycling in Aotearoa New Zealand can be found in Appendix A.

> *If it weren't for my cycle, I wouldn't be able to see as much of New Zealand. I wouldn't have these trips with my friends. I wouldn't have any way to easily exercise.*
>
> Debbie, 64, handcycle

[1] Statistics New Zealand. *Disability survey: 2013*. Retrieved from Stats NZ - Tatauranga Aotearoa: https://www.stats.govt.nz/information-releases/disability-survey-2013

[2] Burdett, B., & Thomas, F. (2021). *Equity in Auckland's Transport System.* Auckland: Ministry of Transport. Retrieved from https://www.transport.govt.nz//assets/Uploads/Report/EquityinAucklandsTransportSystem2.pdf

[3] TRA. (2022). *2021 Understanding Attitudes and Perceptions of Cycling and Walking.* Wellington: Waka Kotahi. Retrieved from https://nzta.govt.nz/assets/resources/understanding-attitudes-and-perceptions-of-cycling-and-walking/Waka-Kotahi-Attitudes-to-cycling-and-walking-final-report-2021.pdf

[4] Wheels for Wellbeing. (2022). *Disability and Cycling: Report of 2021 National Survey Results.* London: Wheels for Wellbeing. Retrieved from https://wheelsforwellbeing.org.uk/wp-content/uploads/2022/05/Disability-and-Cycling-Report-of-2021-national-survey-results.pdf

Benefits of cycling for disabled people

Numerous studies show the benefits of cycling to individuals as well as society at large, including improved physical and mental health, productivity gains and low environmental impact. The benefits to disabled people are vast, especially given that disabled people are more likely to be physically inactive and socially isolated[5,6].

These benefits can include:

- **Improved physical health and strength** due to increased exercise.
- **Improved mental wellbeing** due to exercise, development of confidence and skills, and increased social interaction, as well as a sense of freedom and independence.
- **Environmental benefits** from reduced reliance on use of larger, more energy intensive vehicles, and reduced congestion.
- **Financial benefits** from reduced reliance on motor vehicles, as well as increased travel independence potentially reducing reliance on paid personal assistance.
- **Social benefits** from the increased ease for people to meet friends and family, go to leisure activities, and general move around and participate in their community.

> It's not just about mobility, it's about wellbeing… …the feeling of enjoyment and independence cycling can bring.
>
> Lyndal Johansson, Waka Kotahi Education Advisor

[5] Wheels for Wellbeing. (2020). *A Guide to Inclusive Cycling, 4th ed.* London: Wheels for Wellbeing. Retrieved from https://wheelsforwellbeing.org.uk/wp-content/uploads/2020/12/FC_WfW-Inclusive-Guide_FINAL_V03.pdf

[6] Waka Kotahi. (n.d.). *Health and Wellbeing.* Wellington: Waka Kotahi. Retrieved from https://www.nzta.govt.nz/walking-cycling-and-public-transport/cycling/workplace-cycling-guide/why/health-and-wellbeing/

Types of cycle

People use a wide variety of non-standard cycles depending on their needs. Examples of cycles that are currently available are shown in Table 1 below.

Tricycle

Tandem bicycle

Handcycle

Recumbent tricycle

Recumbent handcycle

E-bike

(Image source: Electric Bike Team)

Table 1 (part 1): Variety of cycles in common use[7]

> *Recumbent trikes are 50% more stable as the rider is much lower to the ground.*
>
> Brian Gilbert, Manager, Trikes NZ

[7] All images except where specified otherwise sourced from https://www.trikesnz.co.nz with permission.

Wheelchair tandem

Wheelchair clip-on

Cargo tricycle
(Image source: www.dutchcargo.co.nz)

Cycle trailer
(Image source: Wike Bicycle Company)

Stabiliser wheels (for children or adults)
(Image credit: www.stabilizerwheels.com)

Electric recumbent tricycle
(Image source: www.electrictrike.com)

Table 1 (part 2): Varieties of cycles in common use (continued)

Design vehicle

One implication of the wide variety of cycle types on cycle facility design is the need to use a 'design vehicle' to test its accessibility. The design vehicle represents a composite of the maximum dimensions of the cycles often used by disabled people, including mobility trikes and recumbents. The recommended design vehicle is 1200mm wide by 2600mm long, similar to a wide, long-wheelbase tricycle.

Cycles with long wheelbases require a larger turning circle than standard cycles (usually a minimum of 4m). Further some disabilities will make turning tight corners more challenging. Both Kootenay Adaptive Sport Association (KASA) adaptive trail guide[8] and the New Zealand cycle trail design guidance (2019) for Grade 1 riders[9] note the ideal minimum radius for cycling is 6m. The 6m is for cycles travelling at very low speed (e.g., around a switchback, through a chicane, or turning into a crossing). This is the minimum required to allow access for long wheelbase trikes or quadcycles, however these turns will be quite awkward to negotiate for some people.

The minimum radius of horizontal curves when people are moving at a comfortable cycling speed is covered in the *Access* guidance section of this document.

> *We design custom bikes to suit a person's body, many of them with electric assist. We help people with Down syndrome, cerebral palsy, multiple sclerosis, amputees, balance issues, and stroke clients, to name a few. Everyone's different.*
>
> Brian Gilbert, Manager, Trikes NZ

[8] Kootenay Adaptive Sport Association (2020) *Adaptive Trial Standards.* Retrieved from: https://kootenayadaptive.com/wp-content/uploads/2021/03/KASA-Adaptive-Standard_FINAL-EDIT2.pdf

[9] Nga Haerenga The New Zealand Cycle Trail (2019) *New Zealand Cycle Trail Design Guide.* Wellington: MBIE. Retrieved from: https://www.nzcycletrail.com/assets/MemberDocuments/Cycle-Trail-Design-Guide-5th-edition-final-Aug2019-Print-Copy.pdf

Barriers and enablers to cycling for disabled people

The most common barriers to cycling for disabled people cited in a recent survey conducted by Wheels for Wellbeing in the United Kingdom are[10]:

- Infrastructure
- Parking and storage of cycles
- Cost of ownership
- Lack of opportunities for trying cycling or hiring cycles
- Abuse and hostility directed at disabled people cycling
- Cycles are not (legally) recognised as a mobility device

Common complaints relating to infrastructure include:

- Physical barriers, such as gates, chicanes, and 'A-frame' barriers
- Poor cycle facility design, construction, or maintenance, for example poor surface quality or insufficient width
- Lack of secure and accessible parking

Enablers to cycling for disabled people address the main barriers identified. In the Wheels to Wellbeing survey, enablers to cycling include:

- Accessible infrastructure
- Reduced speeds and volume of traffic in residential areas
- Governmental support in the form of subsidies for non-standard cycles, e.g., mobility tricycles
- Supportive imagery and language in guidance and media

Free-text survey responses also included themes of facilitating access to public transport by cycle and safe and supportive cycling environments.

This guidance focusses on making cycling infrastructure and parking of cycles accessible.

> *I wish cycle paths could be bigger, and further away from the roads. The cars are so loud that I can't hear other cyclists behind or ahead of me. It's not good.*
>
> Rawiri, 15, standard bicycle

[10] Retrieved from Disability-and-Cycling-Report-of-2021-national-survey-results.pdf (wheelsforwellbeing.org.uk)

Accessible cycling infrastructure

Providing accessible infrastructure is critical to enabling cycling for disabled people. This section first sets out principles for cycling infrastructure planning and design and then lists common issues with infrastructure and possible solutions. It is important to engage early and often with disabled people and affiliated organisations throughout the planning and design process. This will allow the voices of users to have input into the entire process.

Design Principles for accessible cycling infrastructure

For cycling infrastructure to be accessible, five main principles should be met:

- Safety
- Coherence
- Directness
- Comfort
- Attractiveness

At the most basic level, accessible cycling infrastructure should be step-free, offer a continuous and uninterrupted journey, and have clear and accessible wayfinding. It should also be providing a space where people feel safe and comfortable.

The greatest hazard impacting safety of all people cycling is exposure to high-volume and/or high-speed motor vehicle traffic. This particularly affects the safety and comfort of disabled people cycling, who may travel at lower speeds, be less manoeuvrable, and be more likely to have a sensory impairment than non-disabled people on standard bicycles. If a cycle route is not protected from motor vehicles, a person cycling may choose to cycle on the footpath, or to not ride at all. For these reasons, elimination, mitigation, and minimisation of exposure to traffic is key to street design for accessible cycling.

> *Cycling used to be a lot of fun, but the roads are getting so busy and dangerous out here.*
>
> Debbie, 64, handcycle

Choosing a cycle facility type

Streets should either be designed to ensure low motor vehicle volumes and speeds or should feature physically separated cycle paths. A 'survivable speed' of 30km/h is considered the maximum safe design speed between vehicles and either pedestrians or people cycling, given that a person's chance of death or serious injury rapidly increases at speeds above 30km/h.

Figure 2 provides an indication of what cycle facility types may be appropriate for streets of different traffic speeds and volumes. Facilities aiming to cater for all ages and abilities should be designed towards the more conservative end of this guidance. As an example, when designing for a marginal case, such as 3000 vehicles per day at 50km per hour, separated cycle paths are recommended.

In streets where the traffic speed is greater than 30km/h, paint-only (unprotected) cycle lanes are less safe, and their use should be considered as a last resort. When used, paint-only cycle lanes should:

- Not be adjacent to on-street car parking.
- Not be on multi-lane streets, which enable higher speeds.
- Not include small radius inside bends, especially where sightlines are limited.
- Include a painted buffer wherever possible and always where volumes and speeds approach the upper region of the green band in Figure 2.
- Not include channels, catchpits nor other hazards as part of their width. Hazards should be clearly advertised to users.
- Not be where vehicles volumes and speeds are such that the guidance in Figure 2 suggests a separated facility.

Further guidance on facility type options can be found in the Cycling Network Guidance at https://www.nzta.govt.nz/walking-cycling-and-public-transport/cycling/cycling-standards-and-guidance/cycling-network-guidance/designing-a-cycle-facility/ NZ Transport Agency Waka Kotahi Cycling Network Guidance: Designing a cycle facility.

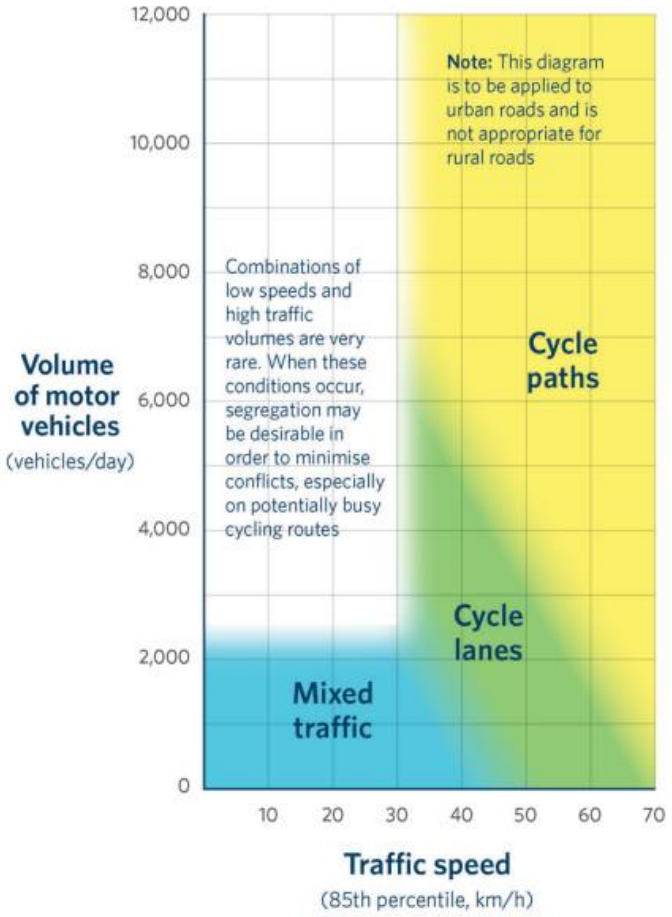


Figure 2: Preferred separation of cycles and motor vehicles according to traffic speed and volume (Waka Kotahi)

To provide for accessible cycling infrastructure, conflict points should generally be designed to offer right-of-way to cycling over motor vehicle traffic in accordance with the transport user hierarchy. The hierarchy is designed such that the most efficient, sustainable, and accessible modes are time-competitive and attractive, but it also particularly benefits many disabled people, who may find stopping, starting, or perceiving surrounding hazards more challenging than non-disabled people.

Streets and cycling infrastructure should be designed to reduce and simplify conflict points with traffic, and to simplify hazard identification and decision making. This makes streets safer and simpler for all people, and particularly benefits disabled people.

Cycling infrastructure should be designed in accordance with the more detailed design guidance covered in the sections below, to be accessible for disabled people and people on non-standard cycles. The rest of this section explains problems disabled people typically encounter when cycling, and how cycling infrastructure design can respond. The problems relate to:

- Access
- Geometry
- Surfacing
- Intersections
- Legibility
- Cycle parking

These sections outline how specific design problems can affect cycle users and provide solutions to these problems.

Real world design of cycleways will often come across combinations of different issues which are greater than the sum of their parts, amplifying hazards or inconveniences to disabled people cycling. For example, the horizontal curve in a cycleway combined with a kerb ramp at an angle could cause people using tricycles to tip over, while neither of those design elements on their own would cause the same problem.

> *The road to school is too busy and it isn't safe for me. There is no cycle lane, and there are lots of trucks and cars. I wish there were cycleways that would let me get to school. Then I'd be able to spend more time on my bike and go straight to my friends' places after school, too.*
>
> Rawiri, 15, standard bicycle

Access design guidance

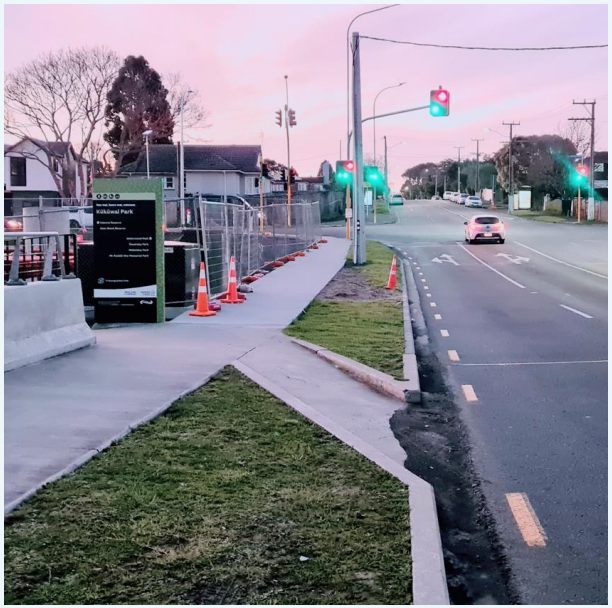
This section outlines access-related problems and solutions, covering cycleway widths, entrances and exits to cycleways, bollards, barriers, and temporary closures. These elements all need to be designed with sufficient space for larger cycles to allow the same access as that given to people riding standard bicycles.

The need for access control barriers should first be scrutinised using the NZ Transport Agency Waka Kotahi Access Control Devices on Paths Design Guidance[11]. To support universal access and Safe System principles, the default position is that access control devices will typically not be present on facilities used by people cycling.

[11] https://www.nzta.govt.nz/resources/access-control-devices-on-paths/

Width requirements for wider cycles	
Problem	**Solutions**
The greater width, length and weight of cycles used by disabled people make narrow cycle paths inaccessible, particularly kerb-protected cycle path at carriageway level. Painted cycle lanes should only be used under specific circumstances (as outlined on page 13), but where they are used, they should be wide enough to accommodate all cycle types. Figure 3 below shows an example of a narrow cycle path with concrete separators.  *Figure 3: A cycle path too narrow for some tricycles, 1100mm between kerb faces - Victoria Street West, Auckland (Lukas Adam, 2022)*	One-way cycle paths should be designed to a minimum width of 2.1m, with isolated sections at an absolute minimum of 1.5m. Two-way cycle paths should be at least 3.0m wide, with short sections at an absolute minimum of 2.3m wide if necessary. More detail is provided in NZ Transport Agency Waka Kotahi's Cycling Network Guidance[12]. When the cycleway narrows below the minimum width, complementary measures should be implemented to warn people, e.g., change in colour, texture, and signage. A key safety and usability consideration is that many users will not be able to overtake on minimum width sections of uni-directional cycle paths; and passing in opposite directions on absolute minimum width sections of bi-directional cycle paths. Therefore, designers should avoid these dimensions wherever possible, and where they are used ensure the length of such sections are minimised, the context is carefully considered, and sightlines are clear. Hazards such as catch-pits (unless cycle-safe) should not form part of the usable width of cycle paths. Where the hazard cannot be removed completely, measures should be included to highlight such hazards to users given the hazard tracking over something like a catch pit can pose.  *Figure 4: An ample width bi-directional cycle path – Christchurch (Lukas Adam, 2022)*

[12] Waka Kotahi. (n.d.). *Cycling Network Guidance.* Wellington: Waka Kotahi. Retrieved https://www.nzta.govt.nz/walking-cycling-and-public-transport/cycling/cycling-standards-and-guidance/cycling-network-guidance/designing-a-cycle-facility/between-intersections/separated-cycleways/

Access to/from cycleways, footpaths, and cycle parking	
Problem	**Solutions**
Kerbs are important in separating cycle traffic from motor and pedestrian traffic, but they should be designed to allow access to and from the cycle lane or cycle path, the footpath, or cycle parking. Link paths and gaps in kerb islands or separators can prevent access by people riding wide cycles if they are too narrow or the approach angle is too sharp. The geometry of the link path needs to factor in device tracking and expected speed.  *Figure 5: This dedicated 1.2m wide link path is too narrow for wide cycles. Richardson Road, Auckland (Sam Hood, 2022)*	Link paths should be at least 1500mm wide, as should the gaps between cycle path separators at locations where people may need to enter or exit a cycle path. Sufficient space is also needed for the turning radius required for wider cycles to enter and exit angled ramps, with a comfortable clearance. Where the approach angle is oblique, kerb ramp widths will need to be increased proportionately. Standard vehicle kerbs are required along the kerbside traffic/parking lane. Where a painted cycle lane is present, frequent kerb ramps should be included to allow access, including by people on a range of cycle types. Driveway crossing ramps often serve this purpose, but dedicated kerb ramps will be required to access cycle parking and at regular spacing where no driveways are present, for example along a town centre main street or alongside a park or waterfront. Driveway ramps often have lips which may reduce accessibility if they are 10- 20mm depending on the angle of the approach. Cycle paths should feature standard vehicle kerbs alongside the carriageway and bevelled kerbs on either side of the cycleway. The bevelled kerbs should have a maximum gradient of 1:3 and have no lip at the cycle surface (refer to Figure 6). Additionally, many cycle users are multi-modal, and rely on safe, legible, and convenient access to and from other modes, such as buses, trains, ferries, and motor vehicles, which together form an integrated transport network. In the case of cars, access between mobility car parks and cycle paths should be considered.  *Figure 6: A bevelled kerb on the footpath (left) side of the cycle path on Karangahape Road, Auckland. Note that the kerb on the right side does not meet the above guidance and may pose risk of pedal-strike. (Sam Hood, 2021)*

Bollards	
Problem	**Solutions**
Bollards can be used to restrict motor vehicle access to streets and create comfortable conditions for cycling, but access control bollards should not restrict use by large cycles. Figure 7 shows an unnecessary bollard that could make passage difficult, or impossible for people on large cycles.  *Figure 7: This bollard is unnecessary for motor vehicle access control and restricts manoeuvring space at a tight corner - North-western Cycleway, Carrington Road, Auckland (Sam Hood, 2022)*	Consider removing unnecessary bollards. The Access Control Devices Design Guidance Note[13] provides advice on this topic. Where deemed necessary, bollards should be spaced with opening widths of between 1400mm (minimum) and 1800mm (maximum). They should be placed to allow people cycling to approach in a straight line whilst permitting all types of cycle to gain access. Visibility is also important. Bright and reflective surfacing on the bollards, as well as on pavements leading up to the bollard, should be used to warn people cycling of the potential hazard. Bollards should be in locations with good sightlines and simple geometry to give people opportunity to respond to the hazard, as well as minimise the complexity of movement around it.  *Figure 8: Appropriate bollard design, featuring a tall bollard with coloured reflective treatment, good sightlines, and clear delineation on approaches (NZ Transport Agency Waka Kotahi)*

[13] https://www.nzta.govt.nz/resources/access-control-devices-on-paths/

Access control barriers

Problem

Some people cycling cannot dismount to wheel their cycle through access control barriers or lift their cycle over an access control barrier. Problematic designs include ‘squeeze’ barriers, tight chicanes, and ‘kissing gates’. Streets, public open spaces, and trails that include access control barriers can prevent access by disabled people cycling and others.

Figure 9: Squeeze barrier (top - Waiōtahe, Opotiki (Malcolm McCracken, 2021) and kissing gates (bottom Hawea Track [14]) can prevent access by a large portion of cycle users.

Solution

The need for access control barriers should first be scrutinised using relevant guidance[15]. To support Safe System principles, the default position is that access control devices will typically not be present on facilities used by people cycling. Where barriers are necessary, minimum design requirements apply regarding the barrier’s placement, lighting and visibility, and pavement marking. Well-designed bollards, as shown in Figure 8 (previous page) are the most accessible type of access control barrier.

> *All of the current forms of barriers being used on the national trails are bad… I can sometimes get through them, since my cycle is low enough, but it’s not possible for a lot of people.*
>
> *Cycling is one of the few ways I can access natural beauty. Many trails are impossible in a wheelchair, but reasonable cycling trails (if it weren’t for the gates).*
>
> Debbie, 64, handcycle

Access control barriers using chicanes to slow people cycling down before a potential conflict can also be used. Chicanes should be designed to allow manoeuvring space for people on large cycles to ride through. Figure 10 shows a barrier in Auckland in which the barriers are spaced sufficiently far apart to allow a range of cycles to manoeuvre through slowly.

Figure 10: A chicane-type access control barrier – Te Ara ki Uta ki Tai (Glen Innes to Tāmaki Drive shared path), Auckland (Claire Graham, 2023)

[14] Ministry of Business Innovation and Employment (2019) *New Zealand Cycle Trail Design Guide.* Wellington: MBIE. Retrieved from https://www.mbie.govt.nz/assets/new-zealand-cycle-trail-design-guide.pdf

[15] Waka Kotahi. (2021). *Access Control Devices on Paths Design Guidance Note.* Wellington: Waka Kotahi. Retrieved from https://www.nzta.govt.nz/assets/resources/access-control-devices-on-paths/Access-control-devices-on-paths-design-guidance-note.pdf

Temporary closures	
Problem	**Solution**
Temporary closures of cycle facilities disproportionately impact disabled people cycling. Diversion arrangements that require people cycling to dismount do not accommodate those who cannot wheel their cycles. The placement of roadworks signage on footpaths and cycleways can cause problems for accessibility and safety.  *Figure 11: Shared path closed with no clear diversion route for cycles. The diversion has no formal crossing nor legibility at end of works (Sam Hood, 2021)*	Accessible alternative routes should always be provided where a cycle facility or general carriageway is temporarily closed. Alternatives should be step-free and clearly signposted. They should not require dismounting or walking. Temporary kerb ramps should be wide enough to allow safe use by people on large cycles. Where possible, advanced notice of the disruption should be made to allow planning ahead. Figure 12 shows a high-quality temporary facility replacing a bi-directional cycle path during construction works.  *Figure 12: Temporary protected bi-directional cycle path along diversion route. Symonds Street, Auckland (Sam Hood, 2022)*  *Figure 13: Temporary asphalt kerb-ramp for access around temporary cycleway closure - North-western Cycleway, Auckland (Sam Hood, 2022)*

Geometry and surfacing design guidance

Characteristics of the riding surface, which include geometric design, gradients and cambers, speed bumps, tables and cushions, imperfections, and tactile pavers, affect accessibility of a cycling environment.

Every person riding a cycle will benefit from firm, smooth, and consistent riding surfaces with comfortable gradients.

Gradients and cambers

Problem

Steep ascending gradients can be a barrier for disabled people and older people, who may not be able to stand on cycle pedals to apply more force on uphill sections. Steep cambers in cycleways are common on New Zealand streets due to the crowning of carriageways for drainage and the inclusion of the channel in the effective width of the cycle lane or cycle path. This can impact tricycles in particular because they may be pulled towards the kerb, toward the edge of the path, or even overturn on a steep camber.

Figure 14: A motorway overbridge with a steep gradient – North-western Cycleway, Auckland (replaced with underpass since photo taken) (Bike Auckland, n.d.)

Solution

Gradients and crossfalls should be minimised on routes intended for use by people cycling. The practicable maximum gradient may be affected by topography, especially for cycle facilities at the side of existing roads. The gradient of the entire length of a cycle facility should be considered, with steep sections minimised and opportunities for rest provided. Wherever possible, the gradient should be 3.0% (1:33), up to a maximum of 5.0% (1:20) for sections up to 240m[16]. Where steeper gradients are unavoidable, their maximum lengths should be kept within the limits set out in Table 2. Cycle facilities on steep gradients should be of high quality (e.g., high traction, smooth surface) to maximise the number of people able to use them.

Careful going down somewhere steep because you might not be able to come back up.

Debbie, 64, handcycle

Use	Max. gradient	Preferred max. length
Cycles only	3% (1:33)	No limit
	5% (1:20)	240m (maximum)
	8.33% (1:12)	90m (maximum)
	10%	30m (maximum)
	12.5%	15m
Combined Cycle and pedestrian paths	3% (1:33)	No limit
	5% (1:20)	120m (between landings)
	8.33% (1:12)	45m (between landings)
	10%	9m (between landings)
	12.5%	3m (between landings)
Landings/rest areas	2%	3 m (minimum)*

Interpolation between values is permitted.
*3 m landing excludes a 2 m length of a transition curve at each end.

Table 2: Maximum gradients[17]

Crossfalls, including cambers, should be minimised while allowing for drainage, to a maximum of 3.0% (1:33). Cambers toward the inside of horizontal curves are preferred. Where this is not achievable, adverse crossfall should not exceed 2.0% (1:50).

[16] Auckland Transport (n.d.) *Transport Design Manual Engineering Design Code – Cycling Infrastructure.* Auckland: Auckland Transport. Retrieved from https://at.govt.nz/media/1985455/5794-tdm-engineering-design-code-cycling-infrastructure-version-1.pdf

[17] See footnote 16.

Horizontal curves

Problem

Many non-standard cycles have a larger minimum turning radius, and some users have limited stability and coordination. Either of these can make sharp or constrained turns difficult.

Tight horizontal geometry can also surprise users if there are limited cues or a severe departure from speed environment on the approach.

When tight horizontal geometry is combined with steep crossfalls, the risk of tipping is also increased. This combination is particularly dangerous for users of cycles with three wheels, who may tip.

Figure 15: A problematic combination of having to navigate tight horizontal geometry and mounting of a ramp on an angle simultaneously on Quay St, Auckland. (Lukas Adam, 2023)

Solution

Horizontal geometry should generally be designed to be as straight as possible, with large radius curves[18]. This provides good sightlines for safety, allows for easy manoeuvrability, including for larger cycles and less-able users, and contributes to a comfortable riding experience.

Minimum turning radii for cycles are as set out in Austroads Guide to Road Design Part 6A, which includes Table 3 as well as mode detailed design guidance.

Significant superelevation (crossfall designed into curves to aid turning), adverse crossfalls, as well as sudden changes in crossfall should be avoided as they can present a risk of tipping for users of some cycle types.

Curves with slower design speeds, i.e. tighter geometry, can be problematic as they can reduce stability and comfort for many riders, particularly for trikes.

Table 5.6: Minimum radius of horizontal curves without superelevation

Design speed (km/h)	Minimum radius (m)
20	10
30	25
40	50
50	94

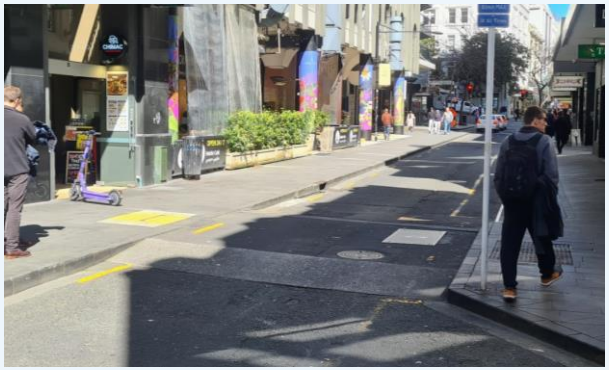
Note: Based on zero superelevation and friction factors of 0.31, 0.28, 0.25 and 0.21 for speeds of 20, 30, 40 and 50 km/h respectively.

Table 5.7: Minimum radius of horizontal curves that have superelevation

	Superelevation (%)				
	2	3	4	5	6
Speed (km/h)	Minimum radius (m)				
20	10	9	9	9	9
30	24	23	22	21	21
40	47	45	43	42	41
50	86	82	79	76	73

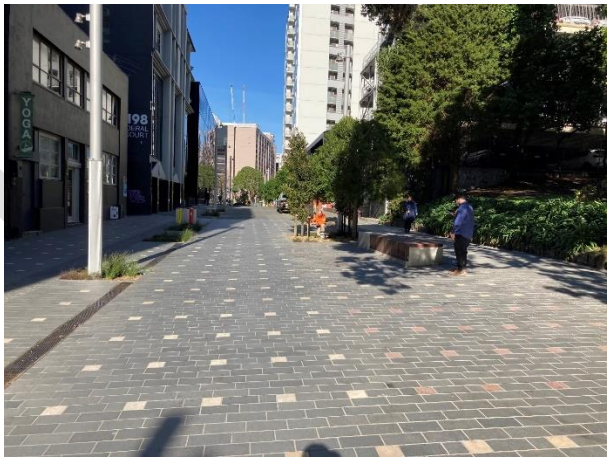
Table 3: Minimum horizontal curves

[18] Austroads Guide to Road Design, Part 6A, page 32. Retrieved from https://austroads.com.au/publications/road-design/agrd06a/media/AGRD06A-17_Guide_to_Road_Design_Part6A_Paths_for_Walking_and_Cycling_Ed2.1.pdf

Vertical deflection - speed humps, tables, and cushions		
Problem	**Solution**	
Sudden or severe changes in gradient, such as speed humps and tables with straight edges can cause stability issues. These can cause the bodies of people using recumbent and hand cycles to collide with the pavement. Figure 16 shows a steep and straight-edged speed hump/table (13.5% or 1:7.4 gradient ramps). Speed cushions introduce cambers, which can cause tricycles to tip over. Avoiding speed cushions by travelling down the centre of the street can put people cycling in an unsafe position.  *Figure 16: A high, straight-edged speed hump/table - High Street, Auckland (Sam Hood, 2022)*	Traffic calming devices on streets with mixed traffic cycling (i.e., no separate cycling facility) should use sinusoidal speed humps across the width of the carriageway, normally 100mm high wherever possible[19], or tables which feature less-severe ramps of no more than 1:15 grade, but ideally 1:20 where cycles commonly mount ramps. Cycle bypasses should be provided where severe speed tables are installed. Speed cushions should be avoided.  *Figure 17: A sinusoidal speed hump - High Street, Auckland (Sam Hood, 2022)*	Neighbourhood greenway[20] cycle routes should include cycle-bypasses of both vertical and horizontal traffic calming features wherever possible, as shown in Figure 18. Bypasses should be a minimum of 1500mm wide so that everyone can use them.  *Figure 18: Traffic calming on neighbourhood greenway - Trafalgar Street, Christchurch (Malcolm McCracken, 2021)*

[19] Auckland Transport (n.d.) *Transport Design Manual Engineering Design Code – Traffic Calming.* Auckland: Auckland Transport. Retrieved from https://at.govt.nz/media/1985457/5794-tdm-engineering-design-code-traffic-calming-version-1.pdf

[20] *Also known as quietways, 'local paths' or bike boulevards*

Imperfections and bumpy surfaces	
Problem	**Solution**
Uneven surfaces can present barriers for accessibility of cycleways and cause severe discomfort – particularly if the person cycling is unable to lift off their saddle to avoid bumps and shocks, such as people who use handcycles. Uneven surfaces include poorly maintained asphalt or concrete, and tactile surfaces such as cobbles or setts (see Figure 19). People riding large cycles of any kind will have more difficulty avoiding obstacles such as potholes.  *Figure 19: Uneven stone setts designed to calm traffic can cause discomfort to some people cycling - Eastern Viaduct, Auckland (Sam Hood, 2022)*	Cycleways and carriageways for mixed traffic cycling should be smooth, level, durable, and safe to use in all weathers. Coarse unit pavers such as brick and stone should generally be avoided on cycle routes, and only used sparingly where they are required to reinforce speed reduction for motor traffic. Gravel, where used on cycle trails, should be compacted to provide a firm, uniform riding surface. Surfaces should be maintained to be free of potholes, uneven pavement joints, leaves, and other debris. Figure 20 shows an example of a high-quality finish meeting both traffic calming and cycling comfort and inclusiveness requirements.  *Figure 20: Smooth stone pavers in a shared space that forms part of a core cycle network - Federal Street, Auckland; (Lukas Adam, 2022)* *Since I can only really see one spot at once, I can't usually watch the road I'm riding on. If there are potholes or uneven bits, it can be scary. I sometimes get flat tires because I don't see uneven parts of the road surface.* Rawiri, 15, standard bicycle

Intersections and legibility design guidance

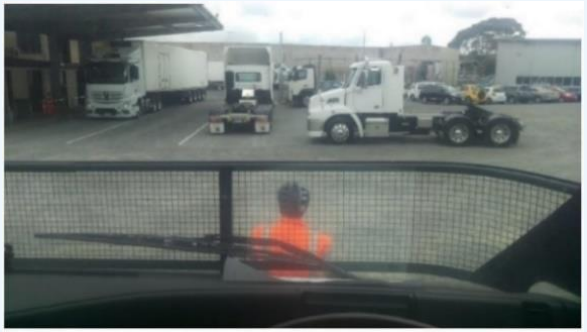
As noted, coherence of cycle facilities is a key principle that can make cycling infrastructure accessible, or not. Legibility of signs and markings is important. It is also important that information about cycle facilities, including printed and online information, is inclusive of the needs of all people.

Advanced stop boxes or lines, hook turn boxes and unclear paths can be difficult to navigate for disabled people cycling, who often have different constraints to non-disabled people. Shared spaces and bus stop bypasses can present difficulties for disabled people, both on cycles and on foot, depending on their design. It is important to ensure that all people are considered within the design of shared spaces, so that all aspects of the design are universally accessible.

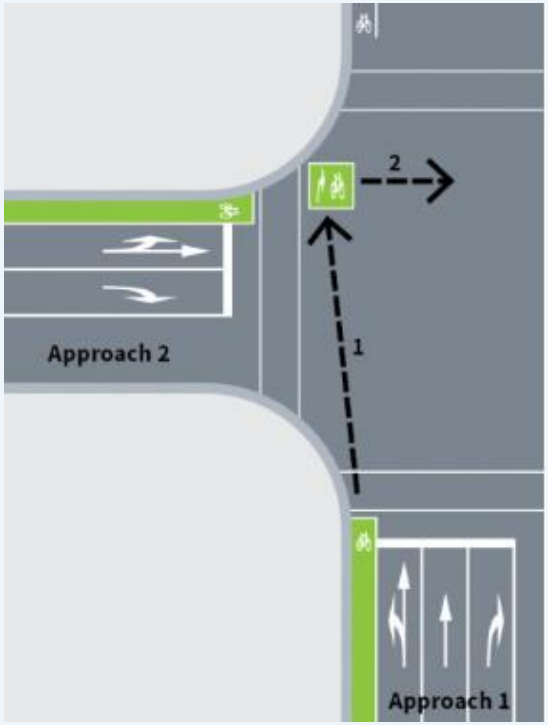
Roadway art is becoming widely used on our streets and paths, particularly for trialling changes to our streets. Care needs to be taken to understand how colour and patterns can be perceived differently by different user groups. Special considerations should be made through the design process to acknowledge our most vulnerable road users particularly those with impairments as well as intellectual disabilities, head injuries, mental illnesses, and visual issues such as colour blindness and people who are neurodivergent. Roadway art projects that include a diversity of users must engage vulnerable user groups, especially, in relation to use of colour; patterns; and safe routes.

It is crucial to follow the TCD Rule, the Roadway Art Clause 5.6(1)[21] to understand when it is appropriate to install roadway art in the roadway.

[21] Ministry of Transport. (2022, May 19). *Traffic Control Devices 2004 Rule (as of 19 May 2022)*. Retrieved from https://www.nzta.govt.nz/assets/resources/rules/docs/traffic-control-devices-2004-as-at-19-may-2022.pdf

Intersection design: advanced stop boxes/lines, physical protection, and signal phasing		
Problem	**Solution**	
Advanced stop boxes (ASB) or advanced stop lines (ASL), can be difficult to use for people who need more time and effort to generate momentum from a stationary start. This includes people who use handcycles and those unable to stand on their pedals to exert more force. People in riding positions lower to the ground, such are people who use recumbent cycles, often feel vulnerable at ASBs or ASLs as they fear being less visible to vehicle drivers (see Figure 21). Another issue that disproportionately impacts disabled people cycling is frequent requirements to stop and start again, which can prove exhausting.  *Figure 21: Example of reduced view of an adult positioned in front of a heavy goods vehicle straddling a standard geometry bicycle (Simon Kennett, 2018)*	Signalised intersections should either have physically separated cycling space (refer to Figure 22) or specific signal phases to separate cycles from motor vehicles. Ideally, the waiting space for people cycling is separated from the walking space, as well as the driving space. Gradients and crossfalls in waiting spaces should be minimised. Where waiting spaces for people cycling are delineated by paint only, buffering between limit lines and advanced stop boxes[22] should be considered to improve the visibility of people cycling, especially from heavy vehicles. Cycleway design should always consider the experience of the people cycling through sequential intersections and how often they might be required to stop. This is of particular importance to disabled people cycling. Green time should allow for those cycling at lower-than-average speeds, which includes some disabled people cycling. Separate phasing for people cycling greatly reduces potential conflicts between people cycling and motor vehicles. Head starts of at least 4 seconds[23] can be provided by displaying a green light for people cycling in advance of the green light for general traffic.	They can be used in combination with ASLs & ASBs with lead in lanes. ASBs without lead in lanes have limited benefit but are preferable to no treatment at all. Buffered ASBs should be used where appropriate to improve safety outcomes[24]. Balancing aids at traffic lights are useful for all people cycling, especially those who require assistance when pushing off from a stationary position at a red light. Push buttons should also be located where people riding all types of cycles can reach them (with the front wheel off the roadway). Note: 300mm standard signal aspects (not 200mm) are recommended for cycle signals.  *Figure 22: Separated waiting space at a signalised intersection. Bremner Road/Auranga Drive, Auranga (Malcolm McCracken, 2022)*

[22] See Waka Kotahi guidance at https://www.nzta.govt.nz/assets/resources/buffered-advance-stop-box/Buffered-advance-stop-box-design-guidance-note.pdf
[23] See Wheels for Wellbeing. (2020). *A Guide to Inclusive Cycling, 4th ed.* London: Wheels for Wellbeing. Retrieved from https://wheelsforwellbeing.org.uk/wp-content/uploads/2020/12/FC_WfW-Inclusive-Guide_FINAL_V03.pdf
[24] See footnote 20

Intersection design: hook-turns	
Problem	**Solution**
Some types of cycle offer more limited manoeuvrability, such as those with long wheel-bases or three wheels, and some riders are less-capable of sharp or precise manoeuvres, which are required to perform hook-turns.  *Figure 23: Hook-turn general arrangement (Waka Kotahi)*	The best solutions are intersections where people cycling are protected from conflicts with motor vehicle traffic either through full physical protection (as shown in Figure 22 on the previous page) or dedicated signal phases for cycle movements. When hook-turns must be used, they should be large enough and sufficient time should be provided for access by non-standard cycles and people cycling who cannot perform sharp or precise manoeuvres. An example is shown in Figure 24. Disabled people cycling making right turns using pedestrian crossings and kerb ramps may be feasible in some cases, although consideration would be needed to turning radii, gradients, and how this option is communicated with signage or surface markings. For this manoeuvre to be legal for riders in general, the crossing would need to include a cycle crossing.  *Figure 24: A hook-turn box on a flat surface with space for manoeuvring around it in Christchurch (Jeanette Ward)*

Bus stop bypasses	
Problem	**Solution**
Designing for interactions between people cycling and bus passengers involves challenges and compromises. Bus stop bypasses (where the cycleway passes around the bus stop, on the footpath) are considered the best practice method of managing this conflict on high-speed or high-volume streets. Some bypass designs feature details which lead to poor outcomes for people cycling, such as: • Sharp bends or/and ramps on the cycleway • Insufficient cycleway width • Poor sightlines and visibility between users • High speeds at conflict points between people cycling and people getting on/off buses • People not identifying the potential for conflict • Poor differentiation between space for cycling and space for pedestrians • Visually complex designs  *Figure 25: A bypass too narrow for some users (1.25m), with sharp grade changes. Victoria Street, Auckland. (Sam Hood, 2022)*	The width and reduced manoeuvrability of non-standard and large cycles should be comfortably accommodated in bus stop bypass designs, with consideration given to people who cannot perform tight manoeuvres. For the safety of people cycling and pedestrians, spaces for cycling only and spaces for pedestrians only should be clearly delineated from each other, with markings and materials. Crossings for bus patrons should be clearly marked and have tactile ground surface indicators. More detail is available in NZ Transport Agency Waka Kotahi Public Transport Design Guidance[25]. Any ramps on the cycleway should be clearly marked with small hump ramp markings and have a maximum gradient of 1:15. The design should encourage safe cycle speeds at conflict points, and those conflict points should be clearly marked with appropriate sightlines for everyone. Be particularly mindful of sightlines being obscured by shelters. To aid awareness, audio announcements could be included at the stop and/or on buses letting people know when a stop is next to a cycleway. Passengers can be informed of the need to cross the cycleway to get to the bus/to the footpath.  *Figure 26: Bus stop bypass featuring clearly differentiated cycleway with clear markings and varied materials, appropriate geometry, tactile pavers, conspicuous crossing. Visibility could be improved if there were clear glass panels at both ends of the bus shelter. (Sam Hood, 2020)*

25 See Waka Kotahi guidance at https://www.nzta.govt.nz/walking-cycling-and-public-transport/public-transport/public-transport-design-guidance/bus-stop/bus-stop-design/integrating-bus-stops-with-cycling/bus-stops-with-separated-cycleways/key-components-of-island-bus-stop-design/

Route coherence and legibility		
Problem	**Solution**	
Route coherence and legibility are different for different people. Many people are unable to dismount easily, negotiate tight or complex manoeuvres, recognise subtle cues about where they are supposed to ride, or read excessive signage or complex maps while concentrating on their travel. The example in Figure 27 below features a temporary cycleway diversion due to construction works. The diversion route (to the left of the 'keep right' sign) is not legible to all people.  *Figure 27: Upper Queen Street, Auckland (Sam Hood, 2022)*	Permanent and temporary cycle routes should be clear and legible. Cycles should be clearly separated from both pedestrian and vehicle space wherever possible. Routes should not require people on cycles to dismount. Cycleway 'design cues' should be as consistent as possible to assist with identification by all people, such as position on street, materials, markings, and colour. The use of colour and art in designs can be effective to emphasise the place function of a street and is often used in temporary facilities. The use of art on cycling routes should consider the experience of the facility for all people, including people with vision impairments or who are neurodivergent, as it has the potential to be confusing. Early engagement and communication can help find solutions that will work for everyone. Local path cycle routes can be designed to be clearly legible to all people, as shown in Figure 28. This could also include redesigning intersections to make the cycle route the priority route, decreasing speeds and increasing safety. Signage, markings and wayfinding to guide the user should only be used to support legible design, rather than as a means of correcting routes with poor legibility. Further guidance on these aspects can be found in the following section, 'Signage, materials and markings'.	A cycling network should also be supported by up-to-date maps. While cycling networks should be designed to be inclusive throughout, there may be times when supporting maps are used to highlight 'inclusive mobility' routes which cater for all people cycling. Such routes should adhere to the design guidance set out in this document, including supporting the recommended design vehicle. In addition to this, cycle routes which do not support all users e.g., those with squeeze barriers or steep grades, should advertise this clearly, such as where users join the route and on maps. Further guidance can be found in the Cycle Wayfinding and Signs and Markings to Designate paths for Pedestrians and Cyclists guidance notes in the Cycling Network Guidance.  *Figure 28: Clear and legible cycle wayfinding. Signage supports, rather than leads for legible design – intersection of Buccleugh St and Cashel St, Christchurch (Malcolm McCracken, 2022)*

Signage, materials and markings	
Problem	**Solution**
The edges of cycleways as well as other hazards are, in many cases, not clearly visible to all users, such as those who have poor vision or slower reaction times. Notable hazards include bollards (as covered in this guide), cycle path separators, kerbs, or drop-offs. It is also important to consider visibility of oncoming cycleway users and consider where centrelines should be marked.  *Figure 29: Shared path with steep unprotected drop-off on one side, low-contrast separators on the other, and no markings making shared path extents. Portobello Road, Dunedin. (Simon Kennett, 2022)*	Signage and markings play an important role in supporting legibility of both the cycling network, as well as highlighting hazards and the edges on each cycleway. Signage and markings should not be solely relied on in place of legible design, such as pavement choices, kerb lines or physical separation. Materials should be considered carefully to ensure legibility and visibility, such as choosing cycleway pavements of different material, colour or texture from surrounding streetscape elements. Kerbs and barriers, such as cycle path separators, which contrast with their surroundings and include reflective elements where appropriate can also be useful. Sufficient clearances between hazards and cycleway edge/centre markings should always be provided, markings should be reflective and tactile markings should be considered, particularly for unexpected hazards within the cycleway. Tapers to avoid hazards should begin well in advance of the hazard and not be severe in angle. Consideration should also be given to how markings can support the legibility of complex environments, such as continuity lines through non-standard intersection designs, to ensure the route is clear to users, including those who have limited sight. Signage should: • Be positioned in locations and at a height that all users can easily notice read, including those close to the ground, such as people riding recumbent cycles. • Use a font and size which conforms to the Traffic Control Devices (TCD) rule and is significantly contrasted in colour to the sign background. • Signal narrow sections and other hazards. In this guidance we mainly refer to accessibility of signage and markings as they are within the jurisdiction of NZ Transport Agency Waka Kotahi and the TCD rules. Refer to the Cycle Wayfinding Design Guidance Note for more information. Note that it is the responsibility of authorities that produce other types of information about transport to make it as accessible, regardless of delivery format.

Shared zones

Problem

Designs which mix vehicles, pedestrians, and cycles within a flush, shared space can become dangerous and uncomfortable to use for disabled people cycling, and others, if traffic is too fast or vehicle volumes too high.

Shared zones can cause problems for disabled people cycling, who may have difficulty following subtle design cues and feel unsafe when sharing space with motor vehicles, even at low speeds.

Figure 30: Auckland's Federal Street shared zone has long, straight, and wide vehicle paths, experiences significant traffic, and has two exiting lanes. It operates poorly as a shared zone despite high-amenity edges and significant pedestrian traffic. (Sam Hood, 2022)

Solution

Shared zones can work well for disabled people cycling if vehicle speeds and volumes are very low.

The legal boundaries of shared zones are established by installing the A40-7 Shared Zone sign[26], as specified in the TCD Rule.

Designs of shared zones[27] should incorporate measures to convey the street as a pedestrian-focused space where people cycling and driving are expected to travel slowly and yield to people on foot. Such measures should include:

- entries and exits clearly differentiated from normal streets, for example by providing ramps or change in pavement materials[28]
- no physical separation of space by kerbs or level differences
- measures to encourage slow driving such as horizontal deflection, street furniture (e.g. cycle parking) or landscaping treatments, and edge friction. This may be reinforced by introducing a speed limit of 10km/h
- a continuous accessible path, free of obstructions, along the building lines (with 600mm wide, tactile navigational strips to aid low vision pedestrians)
- even lighting

Figure 31: Auckland's O'Connell Street caters to different street uses and features local amenities which allows it to operate successfully as a shared zone (Sam Hood, 2022)

Vehicle restrictions may also be considered, such as regulating delivery access to certain times of the day or restricting motor vehicle movements to one direction. In this case, cycling in both directions can be permitted (with a local bylaw) in order to allow a more direct cycling route which has less exposure to motor vehicle traffic.

A shared zone may be blocked off at one end to prevent motor vehicle through movement, while still allowing people walking and cycling through.

[26] https://www.nzta.govt.nz/resources/traffic-control-devices-manual/sign-specifications/view/778
[27] General guidance for shared zones can be found in the Shared zones section of the Cycling Network Guidance.
[28] Further guidance on pavement materials can be found in 'Imperfections and bumpy surfaces', page 25.

Cycle parking guidance

Accessible cycle parking should be conveniently located and easy to find with step-free access and designed to allow for non-standard cycles. The requirements for parking of many cycles used by disabled people and cargo cycles are often similar. Standard cycle parking designs vary in the proportion of people who would be able to use them. The accessibility of some common examples is outlined in Table 4. More detailed guidance on cycling parking design can be found in the Cycle Parking Planning and Design guidance note[29].

[29] https://www.nzta.govt.nz/resources/cycle-parking-planning-and-design/

Most accessible				Inaccessible
				
Sheffield stands[30]	**'Compact' racks**[31]	**Two-tier racks**[32]	**'Wheel-bender' racks**[33]	**Hanging racks**[34]
RECOMMENDED	**NOT RECOMMENDED**	**NOT RECOMMENDED**	**NOT RECOMMENDED**	**NOT RECOMMENDED**
• Spacing varies, but typically designed for standard bicycles, often more space on the end of a row • Racks keep cycles upright and allow flexibility for locking different frame types	• Narrow spacing limits compatibility with non-standard cycles • Difficult to manoeuvre cycle in from behind • Should only be considered for very compact spaces	• Very narrow spacing limits compatibility with non-standard cycles • Difficult to manoeuvre cycle in from behind • Understanding and strength required to use top level racks (hydraulic assistance varied between models)	• Low rack position supports just one wheel • Often incompatible with wider tyres and 'D' locks • Inaccessible to people not able to reach down or fit in narrow gaps • Poor usability for all people cycling	• Used where space is limited for medium-long stay use • Incompatible with non-standard cycles • Inaccessible to those unable to lift their cycle up to the hook (some disabled people, most people using e-bikes and non-standard cycles)

Table 4: The accessibility of common types of cycle parking

[30] Image: Sheffield parking at University of Canterbury (Sam Hood, 2021)
[31] Image: Compact cycle racks, Auckland (Lukas Adam, 2022)
[32] Image: Two-Tier parking in Nelson City Centre (Sam Hood, 2022)
[33] Image: 'Wheel-bender racks' (Sam Hood, 2019)
[34] Image: Hanging racks, Auckland (Lukas Adam, 2022)

Accessible cycle parking	
Problem	**Solution**
Almost all cycle parking in Aotearoa New Zealand is designed for standard cycles and may be challenging or impossible for people on non-standard cycles to access or use, often due to their larger dimensions. Further to this, many disabled people on standard cycles are unable to use parking which requires the user to lift their cycle (such as two-tier or hanging parking) or requires locking to a point low to the ground.	Accessible cycle parking features step-free access, is close to destinations, is accessible to large-dimension cycles, does not require lifting, and is in a visible, legible location. Such cycle parking should be at least 1.5m wide and should be designed for manoeuvring into without dismounting. A challenge with provision of disabled cycle parking is that the most accessible and openly spaced parking is also often the most desirable for use by for non-disabled people. The parking should be well signposted and differentiated from standard cycle parking to encourage use only by those who need it, such as through use of signs, symbols, and colours of pavements and stands. Where dedicated accessible parking is not provided, signage should be provided which acknowledges this issue and directs people to the most convenient alternative accessible cycle parking.  *Figure 32: Cycle parking featuring dedicated spaces for non-standard cycles. Trafalgar Street, Nelson (Mark Edwards, 2022)*

Monitoring and reporting

Extensive guidance is available in NZ Transport Agency Waka Kotahi's Cycling Network Guidance on monitoring and reporting of cycling infrastructure. Cycle throughput is an important metric to gauge the success of changes to the cycling network, but user types should also be monitored, including disability.

Collecting quantitative data through observational surveys

Observational surveys where people cycling are counted should include a field to record people using non-standard cycles, such as those listed in Table 1. This data is typically recorded alongside pedestrian counts (e.g.; use of mobility aids for pedestrians and scooters) as well as age group and gender.

Collecting qualitative data through interviews

Interviews should include questions about whether the interviewee identifies as a disabled person and whether they use a non-standard cycle to get around. Open questions could be included to allow details to be given about the person's disability and the type of cycle they use and whether they consider it to be a mobility aid. These questions should appear alongside others enquiring about the respondent's suburb of residence, age, gender, and ethnicity. Surveys should also include disabled people who would like to cycle but don't.

> *It's important to talk to the right people - always put designs past disabled people or those working with them.*
>
> Lyndal Johansson, Waka Kotahi
> Education Advisor

Maintenance

It is important that cycle facilities are well-maintained and continue to be easy to use once in place. This includes the need to keep paths and facilities free of debris over their entire width to ensure a range of people using different types of wider cycles, such as tricycles, have sufficient clear safe space. Obstacles on paths also need to be cleared quickly to reduce safety issues and give users confidence the path will remain clear for them. Disabled people cycling will find navigating around obstacles difficult, therefore a regular maintenance programme is recommended. Guidance about maintenance standards and responsibilities can be found in the NZ Transport Agency Waka Kotahi's Specification for Design, Construction and Maintenance of Cycling and Shared Path Facilities document[35] and Visual Audit Guideline.[36]

[35] Waka Kotahi (n.d.) *Specification for Design, Construction and Maintenance of Cycling and Shared Path Facilities.* Retrieved from: https://www.nzta.govt.nz/assets/resources/specification-for-design-construction-and-maintenance-of-cycling-and-shared-path-facilities/Specification-for-design-construction-and-maintenance-of-cycling-and-shared-path-facilities.pdf

[36] Waka Kotahi (n.d.) *Specification for Design, Construction and Maintenance of Cycling and Shared Path Facilities – Visual Audit Guideline.* Retrieved from: https://www.nzta.govt.nz/assets/resources/specification-for-design-construction-and-maintenance-of-cycling-and-shared-path-facilities/Specification-for-design-construction-and-maintenance-of-cycling-and-shared-path-facilities-visual-audit-guideline.pdf

Personas

"I can only see one small spot at once, so I have to choose to look out for traffic, or look at the path in front of me"

Lives:
Hamilton

Capabilities

POOR — GOOD

- Physical abilities
- Sight
- Hearing
- Mental cognitive

Meet Rawiri.

Rawiri has no vision in one eye, and only peripheral vision in his other eye.

He cycles when he is visiting friends, if there is a separated cycle path. He would like to cycle to school, but the streets are too busy and it is easy for him to miss cars and other hazards.

Rawiri relies on his hearing and his knowledge of the different paths to stay safe as he cycles.

Personal Information

Age:
15

Type of Cycle:
Standard mountain bike

Transport Dislikes

- Nowhere to lock my bike
- Uneven surfaces
- Road works

Wishlist

- Smooth paths without holes or cracks
- Quiet places to cycle
- More protected cycle lanes

Daily Statistics

POOR — VARIABLE — GOOD

- Physical wellbeing
- Mental Wellbeing
- Energy

Income

$ $ $ | $ $ $ $ $ $ $

NZ median income $33,000

Find out more at:
https://blindlowvision.org.nz/

"My wheelchair doesn't let me get out into the forests or the hills. Being able to cycle lets me see the beautiful views and be outdoors"

Lives:
Upper Hutt

Capabilities

POOR — GOOD

- Physical abilities
- Sight
- Hearing
- Mental cognitive

Meet Marie.

Marie has weakness in her lower body, and often has severe pain in her legs. She uses a wheelchair to get around.

Marie uses her recumbent hand-cycle to exercise and get into nature. She enjoys cycling with her friends.

Marie often has to stop her rides and return home because she encounters a barrier she can't pass, such as a squeeze barrier or a fence.

Personal Information

Age:
64

Type of Cycle:
Recumbent hand-cycle (electric assist)

Transport Dislikes

- Squeeze barriers
- Gates and fences on cycle trails
- Tight turns

Daily Statistics

POOR — VARIABLE — GOOD

- Physical wellbeing
- Mental Wellbeing
- Energy

Wishlist

- Information about the accessibility of cycle paths and trails
- Smooth cycling paths through nature

Income

$ $ $ | $ $ $ $ $ $

NZ median income $33,000

Find out more at:
https://www.mda.org.nz/

"When I cycle, I know I need to follow the white line on the side of the road. If that line is gone I get confused about where I should be"

Lives:
Foxton

Capabilities

POOR — GOOD

- Physical abilities
- Sight
- Hearing
- Mental cognitive

Meet Tara.

Tara has Down syndrome. Some of her verbal communication skills and comprehension skills are limited. She has difficulty with balance.

Tara cycles along the highway to get to and from her art classes, as well as to visit her friends. This involves crossing the busy highway at several points.

Tara cannot drive, so cycling gives her some freedom to travel alone.

Personal Information

Age:
29

Type of Cycle:
Electric tricycle

Transport Dislikes

- No shoulder along busy roads
- Cars and trucks honking as they go past
- Missing lane markings

Wishlist

- Safe crossing points
- Clear lane markings
- Space specifically for cyclists

Daily Statistics

POOR — VARIABLE — GOOD

- Physical wellbeing
- Mental Wellbeing
- Energy

Income

$ $ $ $ $ $ $ $ $ $

NZ median income $33,000

Find out more at:
https://www.peoplefirst.org.nz/

Appendix A Development of the Accessible Cycling Infrastructure guidance note

Methodology

This document was prepared with a desktop literature review, research into precedent and contextual guidance, and interviews. Interviews were carried out with disabled people who cycle and members of industry, to inform the personas and the guidance.

Interviews with disabled people who cycle

Three interviews were carried out with disabled people who cycle. Participants were sought using an advertisement sent out by email to several mailing lists, including those of the Disabled Persons' Assembly and CCS Disability Action. Interviewees were chosen to represent different impairments, ages, locations, and cycle types used. Interviewees were paid for their time.

The interview questions asked about trip patterns, barriers faced, preferred and avoided places to ride, pleasant memories of cycling, and alternatives used when cycling is not possible. Notes were taken and paraphrased quotes recorded during the interviews and the results compiled into a spreadsheet. Personas were then developed based on the interview responses. The names and locations of the participants were changed to protect the interviewees' privacy.

Expert interviews

Interviews were also carried out with two people with professional experience working with disabled people cycling: Lyndal Johansson, a Waka Kotahi Education Advisor, and Brian Gilbert, the Manager of Trikes New Zealand, a specialist retailer of cycles for disabled people. These interviewees were chosen through the professional networks of Waka Kotahi staff. They were asked questions about the range of disabilities and cycles they have worked with, main barriers and enablers for disabled cycling and what role design guidance could play. Their names are included in this document with their consent.

Design guidance

The design guidance in this document was developed by referring to international benchmarks, primarily Wheels for Wellbeing's *A Guide to Inclusive Cycling*. The advice was set in the Aotearoa New Zealand context through a literature review and by integrating with the *Cycling Network Guidance* and referring to other cycling design guidance such as Auckland Transport's *Engineering Code for Cycling Infrastructure*. Material from an early draft of this report was workshopped at the Active Modes Infrastructure Group forum. The guidance is set out as a series of common problems and potential solutions using examples from Aotearoa New Zealand where possible.

Review of draft guidance

The first draft of this design guidance was shared with several organisations representing disabled people in Aotearoa New Zealand. Feedback was received from representatives from the Disabled Persons Assembly, the National Disabled Students' Association, the Accessible Outdoors working group (Recreation Aotearoa), and the *Auckland Cycleway Report for Inclusive Cycling* project (Bike Auckland). This feedback was incorporated into the second draft.

Literature Review

Transport plans, guidance manuals, and technical notes can all draw on existing data to make recommendations. A lack of data around disabled people cycling means guidance tools may not include universal design principles, and instead focus on the groups for which transport data has been collected.

This literature review reviews the existing data around disability and cycling, then outlines the different forms of guidance for cycle network planning and design in Aotearoa New Zealand.

Disability and cycling

Disability in Aotearoa New Zealand

The 2013 New Zealand Disability Survey provides insights into the number of disabled people in Aotearoa New Zealand, the nature of their impairment, and how this varies by ethnicity, age, and location[37]. In this survey, disability is defined as long-term limitation (resulting from impairment) in a person's ability to carry out daily activities.

In 2013, 24% of the Aotearoa New Zealand population were identified as disabled (a total of 1.1 million people). This was an increase from the 2001 rate of 20%. This increase can be partially explained by Aotearoa New Zealand's aging population[38]. The median age is projected to continue to increase, so it is likely that the proportion of the population with disabilities will continue to increase as well[39].

Proportions of different impairment types vary by age group. Forty-seven percent of adults with a disability have a physical disability, compared to only 9% of children. The breakdown of disability types for children are shown in *Figure 33*, and for adults in *Figure 34*[40].

Adults are aged 15 years and older, and children are aged 0 to 14 years. The "other" category includes learning, speaking, and developmental delay for children, and also remembering for adults.

These breakdowns show the diversity of disability types, and their variation by age group.

[37] Statistics New Zealand. *Disability survey: 2013*. Retrieved from Stats NZ - Tatauranga Aotearoa: https://www.stats.govt.nz/information-releases/disability-survey-2013

[38] See 37

[39] Statistics New Zealand. (2020). *National population projections : 2020 (base) - 2073.* Retrieved from Stats NZ - Tatauranga Aotearoa: https://www.stats.govt.nz/information-releases/national-population-projections-2020base2073#:~:text=In%202020%2C%2010%20percent%20of,79.1%E2%80%9383.3%20years%20in%202073

[40] See 37

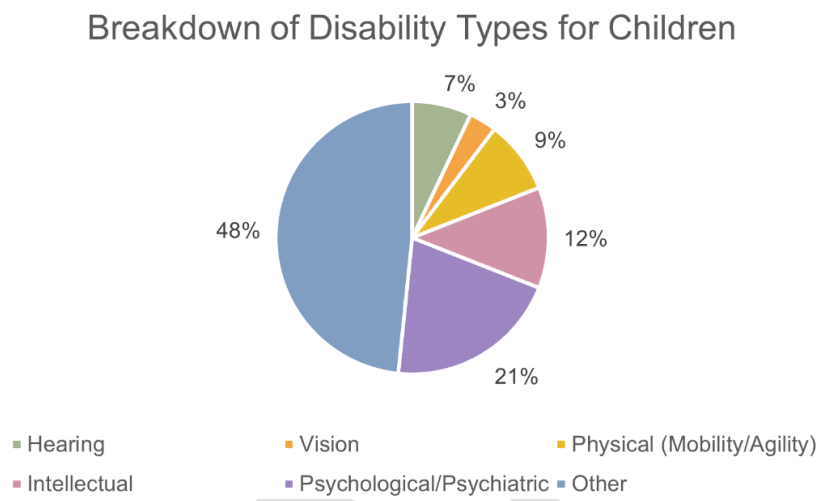


Figure 33: Disability Survey Breakdown of Disability Types for Children

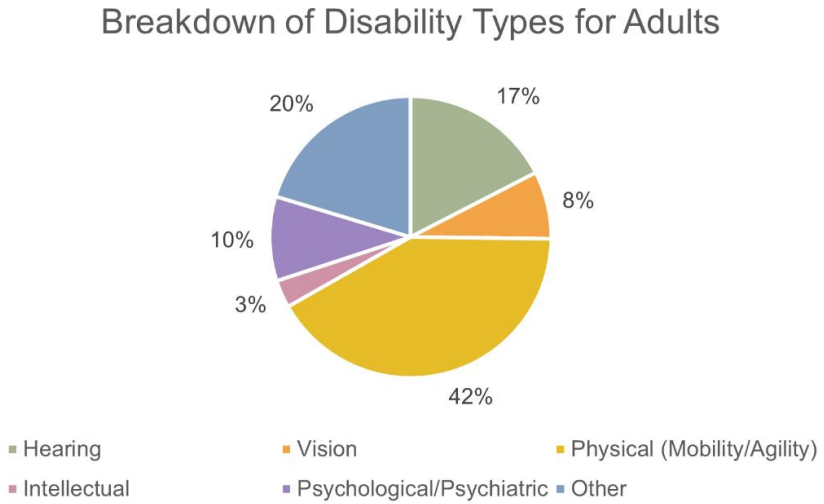


Figure 34: Disability Survey Breakdown of Disability Types for Adults

Transport data for disabled people

Despite the large proportion of New Zealanders who identify as disabled, there is not much data around their travel needs, behaviours, and barriers to transport.

Living with Disability in New Zealand

Living with Disability in New Zealand[41] is a report which combines the results from the 2001 Household Disability Survey and 2001 Disability Survey of Residential Facilities. The publication focuses on the overall prevalence, severity, needs, and opportunities for disabled people in Aotearoa.

This report includes a chapter on travel patterns and use of different forms of private and public transport. The chapter looks at the purpose and frequency of long and short trips, as well as the access to, and use of, private motor vehicles, taxis, and public transport. There is no mention of cycling as a possible travel option, and therefore no discussion of the access requirements or barriers for cycling from different disability types.

For private motor vehicles, there was discussion of how many disabled people in New Zealand:

- Do not have access to a private motor vehicle (i.e., 11% of adults)
- Do not have easy access to public transport (24%)
- Are not drivers (30%), and
- Need to park close to their destination (28%).

One of the listed uses of the report is to "help us to understand the needs of people with disability, and plan more effective and responsive policies and services". It is possible that the lack of information collected about cycling has influenced the lack of further research in this area, and the limited understanding of barriers and requirements for disabled people cycling.

Household Travel Survey

The Household Travel Survey[42] measures the travel of New Zealanders, by collecting travel data from random households over two-day periods.

This survey looks at the proportion of New Zealanders who have long-term conditions or health problems that give them some difficulty using transport. Their definition of using transport includes driving a vehicle, being a passenger in a vehicle, independently using public transport, or independently walking 500m unaided. Once again, cycling and disability are not addressed together.

[41] Ministry of Health. (2005). *Living with Disability in New Zealand.* Wellington: Ministry of Health. Retrieved from https://www.health.govt.nz/system/files/documents/publications/livingwithdisability.pdf.

[42] Ministry of Transport. (2018). *Te Tiro Whānui i Ngā Whare o Aotearoa mō te Haere - New Zealand Household Travel Survey*. Retrieved from Te Manatuu Waka - Ministry of Transport: https://www.transport.govt.nz/area-of-interest/public-transport/new-zealand-household-travel-survey/

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